

Test Report No. H339

Rigid Plastic Sheets

Model: ARCOPLUS SY 626 TRS Bicolore

Test ordered by:

dott. Gallina S.r.l.

Corso Galileo Ferraris, 70
10129 Torino
Italy

Manufacturer:

dott. Gallina S.r.l.

Strada Carignano, 104
10040 La Loggia (To)
Italy

Remarks:

The content of this test report shall not be modified.

The results given in this report relate to the tested sample(s) only.

This test report is made according to the requirements of the test procedures in the chapter 2.1.

This test report fulfils the requirements of ISO 17025.

Rapperswil, 17. August 2021



Dr. Andreas Bohren
Head of SPF Testing



Ozan Türk
Test engineer

1 Summary and main results

Test procedures	Version	Date
ACFI Test Specifications No. 11 Rigid Plastic Sheets	1.04	01.07.2015
ACFI Test Specifications No. 00a General Part A	1.03	01.03.2018
ACFI Test Specifications No. 00b General Part B	1.02	01.12.2018
ACFI Collection of resolutions	24	09.09.2020

Test sequence	Date
Sampling date	N/A
Delivery date	04.05.2021
Test date	14.07.2021
Production ice balls	KW26/ 2021
Final assessment and evaluation	14.07.2021
Special remarks on the test procedure: The test was performed on test specimen H339/1 for roof applications and for facade applications.	

Results		
Impact direction	90° - Roof	45° - Façade
Watertightness	HW5	HW5
Light transmission	HW3	HW4
Light shielding	--	--
Mechanical performance	--	--
Appearance	HW2	HW2
Note: The hail resistance class will only be finally determined by the expert group of the ACFI Expert Commission Elementary Protection Register (FER).		

Table of content	Seite
1 Summary and main results	2
2 Introduction	4
2.1 Remarks on the test sequence	4
2.2 Manufacturer's specification	4
2.3 Specific abbreviations and formats used in the report	4
2.4 Instruments and test devices	4
3 Specimen descriptions	5
3.1 Specimen identification	5
3.2 Description of the support structure	5
3.3 Test Setup.....	6
3.4 Definition of targets	7
3.5 Photographs of targets	8
4 Test protocol	9
4.1 Specimen storage prior to testing (conditioning).....	9
4.2 Specimen treatment before testing	9
4.3 Ambient conditions	9
4.4 Angle of impact	9
4.5 Test protocol	9
5 Evaluation	13
5.1 Component function	13
5.2 Damage criterion.....	13
5.3 Measuring method.....	13
5.4 Evaluation	14
6 Additional brand names	15
Annex A Drawings and specifications	16

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2 Introduction

2.1 Remarks on the test sequence

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2.2 Manufacturer's specification

All manufacturer's specifications in this report have been checked for plausibility by the test laboratory and are therefore not marked further.

2.3 Specific abbreviations and formats used in the report

NR Not required, not relevant

NA Not applicable

NS Not specified

NT Not tested

-- No result as test was not performed

Date and time is always indicated in the format (if applicable) DD.MM.YYYY HH:MM

Indications about tilt angle and sample inclination are always measured from horizontal.

Length always denotes the distance in vertical (south-north) direction as tested

2.4 Instruments and test devices

The instrument types, specifications, serial numbers and calibration status of the instruments and test devices which were used to make the measurements and tests for this test report are filed in an internal database at the test laboratory. Upon request all this information can be made available as required by the ISO 17025.

Ice balls of well-defined diameter and velocity are being shot on the test sample with a compressed-air driven launcher. The ice balls are made of transparent laboratory ice without any visible cracks or inclusions of air bubbles. The ice balls are made from ice blocks using a melting procedure. The ice balls are stored for at least 48h at a temperature of $-20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ before using them for testing. The time between the removal of the storage container and the launching is less than 60 seconds.

Unless otherwise stated, the ice balls are fired horizontally and the test sample is installed vertically. The velocity of the projectile is controlled by the pre-set system pressure. The distance between the point of impact and the measurement of the projectile velocity is less than 1 m. The velocity of the projectiles is measured using photoelectric barriers (Siemens SFH 409-2 & SFH 309). The point of impact is defined by two intersecting laser beams.

The mass of the projectiles is measured directly before launching using an electronic scale (Kern 440-33N).

The tools used for assessment and rating of damages are (as applicable and required by the applicable test specification):

- Visual inspection by two test engineers.
- Vacuum test device according to chapter 8 of the SN EN 13583
- Magnifying glasses (6x magnification)

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3 Specimen descriptions

3.1 Specimen identification

Model	ARCOPLUS SY 626 TRS Bicolore
Description	Multi wall sheet 40 mm thickness, 7 walls
Gross length	1000 mm
Gross width	600 mm
Gross height	40 mm
Material composition	Polycarbonate
Surface treatment / Color	2-sided UV-protection / bicolore (satin clear outside/ satin opal inside)
Serial No of test sample(s)	--
Composition / Cross section	See Annex

Remarks: 1200 x 1000 mm (W x L): 2 panels 600 mm wide and 1000 mm long connected together (tongue and groove).

3.2 Description of the support structure

The specimen was installed in a frame on all sides and mounted on a solid underground. The test specimen (1) is installed vertically in a frame made of aluminum profiles (2). The frame is fixed to a rigid background.

3.3 Test Setup



Figure 1 The test specimen (1) in a frame made of aluminium profiles (2).

3.4 Definition of targets

The multi wall sheet is impacted at the following locations (Figure 2):

- (1) Middle: Circle with a radius of 150 mm at the specimen center
- (2) Corner: Circle with a radius of 25 mm at the coordinate $(1/10 b / 1/10 l)$
- (3) Mid-point between the ribs
- (4) Close to a rib; the distance from the rib is $1/5$ of the projectile diameter

Other critical points determined by the test laboratory:

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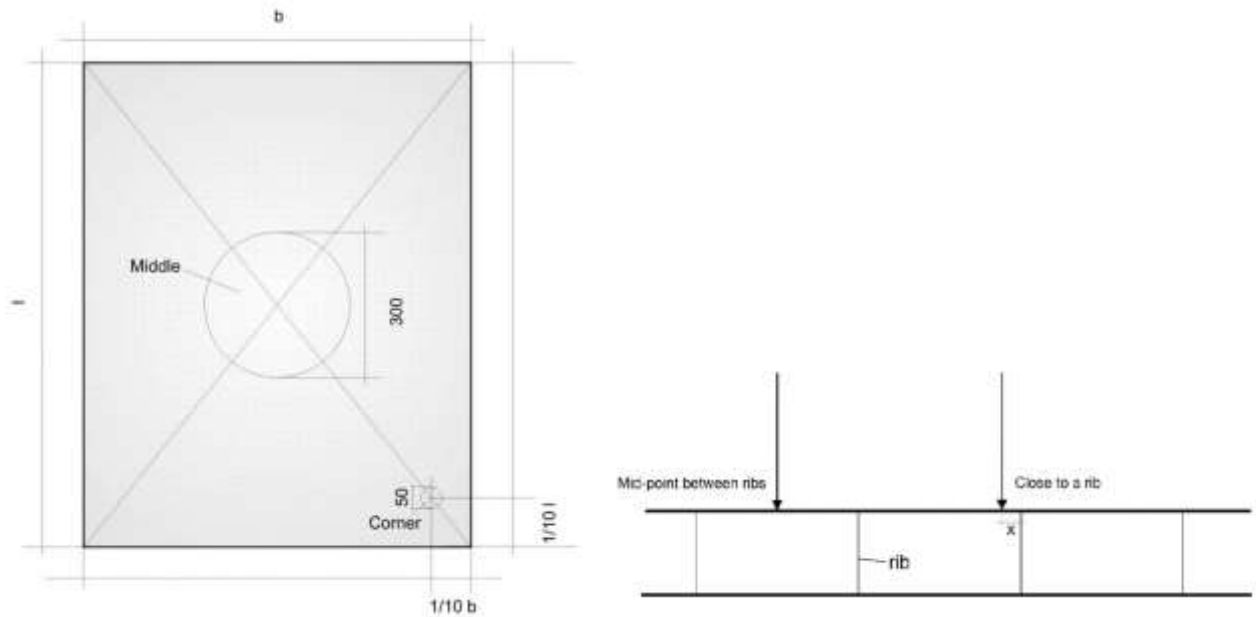


Figure 2: 3.4 Definition of target area

3.5 Photographs of targets



Figure 3: Target area middle (1) Connection area



Figure 4: Target area edge (2)



Figure 5: Target area close to a rib (3)



Figure 6: Target area mid-point between the ribs (4)

4 Test protocol

4.1 Specimen storage prior to testing (conditioning)

The samples were stored at the test climate for more than 3 days before testing.

4.2 Specimen treatment before testing

The samples were cooled with ice flakes for three minutes before testing.

4.3 Ambient conditions

Temperature

$T_{Amb} = 23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Temperature of test sample

$T_{Sample} = 23^{\circ}\text{C} \pm 2^{\circ}\text{C}$

Humidity

$\text{RH} = 50\% \pm 10\%$

4.4 Angle of impact

The angle of impact is 90° for sheets used on the roof and 45° for those used on the façade.

4.5 Test protocol

4.5.1 H339-1 (roof applications)

No.	Target	A [°]	Time	Ø [mm]	M [g]	V [m/s]	E [J]	R
1	(3)	90	14.07.2021 13:46	50	59.85	31.66	30.0	[B]**
2	(3)	90	14.07.2021 13:47	50	59.08	30.76	28.0	[B]**
3	(3)	90	14.07.2021 13:50	50	58.99	30.79	28.0	[B]**
4	(3)	90	14.07.2021 13:51	50	59.35	30.42	27.5	[B]**
5	(3)	90	14.07.2021 13:52	50	60.10	30.55	28.0	[B]**
6	(3)	90	14.07.2021 13:57	40	31.64	27.23	11.7	[B]**
7	(3)	90	14.07.2021 14:00	40	30.61	28.34	12.3	[B]**
8	(3)	90	14.07.2021 14:00	40	30.56	27.55	11.6	[B]**
9	(3)	90	14.07.2021 14:01	40	29.64	26.43	10.4	[X]
10	(3)	90	14.07.2021 14:02	40	30.23	27.46	11.4	[B]**
11	(3)	90	14.07.2021 14:04	40	30.78	27.95	12.0	[B]**
12	(3)	90	14.07.2021 14:10	30	11.99	22.01	2.9	[X]
13	(3)	90	14.07.2021 14:11	30	12.53	24.23	3.7	[B]*
14	(3)	90	14.07.2021 14:12	30	12.21	23.99	3.5	[B]*
15	(3)	90	14.07.2021 14:14	30	12.37	23.87	3.5	[B]*
16	(3)	90	14.07.2021 14:17	30	12.80	24.54	3.9	[B]*
17	(3)	90	14.07.2021 14:18	30	13.54	25.62	4.4	[B]*
18	(4)	90	14.07.2021 14:21	20	3.85	21.92	0.9	[OK]
19	(4)	90	14.07.2021 14:22	20	3.84	22.14	0.9	[OK]
20	(4)	90	14.07.2021 14:22	20	3.79	21.85	0.9	[OK]
21	(4)	90	14.07.2021 14:23	20	3.70	20.63	0.8	[OK]
22	(4)	90	14.07.2021 14:24	20	3.58	21.83	0.9	[OK]

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23	(3)	45	14.07.2021 14:32	50	57.84	31.14	28.0	[B]**
24	(3)	45	14.07.2021 14:34	50	59.35	29.91	26.6	[X]
25	(3)	45	14.07.2021 14:35	50	58.87	31.12	28.5	[B]**
26	(3)	45	14.07.2021 14:35	50	59.33	31.37	29.2	[B]**
27	(3)	45	14.07.2021 14:38	50	59.70	30.50	27.8	[B]**
28	(3)	45	14.07.2021 14:40	50	60.37	30.88	28.8	[B]**
29	(3)	45	14.07.2021 14:43	40	29.75	27.55	11.3	[B]*
30	(3)	45	14.07.2021 14:44	40	29.51	26.50	10.4	[X]
31	(3)	45	14.07.2021 14:45	40	29.29	27.00	10.7	[X]
32	(3)	45	14.07.2021 14:47	40	29.47	28.01	11.6	[B]*
33	(3)	45	14.07.2021 14:52	40	29.55	28.89	12.3	[B]*
34	(3)	45	14.07.2021 14:55	40	29.67	29.66	13.0	[B]*
35	(3)	45	14.07.2021 14:55	40	29.30	27.94	11.4	[B]*
36	(3)	45	14.07.2021 15:00	30	13.53	--		[X]
37	(3)	45	14.07.2021 15:01	30	13.47	25.21	4.3	[B]*
38	(3)	45	14.07.2021 15:02	30	13.45	25.24	4.3	[B]*
39	(3)	45	14.07.2021 15:03	30	13.63	25.06	4.3	[B]*
40	(3)	45	14.07.2021 15:04	30	13.22	24.69	4.0	[B]*
41	(3)	45	14.07.2021 15:05	30	13.57	24.00	3.9	[B]*
42	(4)	45	14.07.2021 15:10	20	3.99	20.73	0.9	[OK]
43	(4)	45	14.07.2021 15:11	20	3.79	20.93	0.8	[OK]
44	(4)	45	14.07.2021 15:12	20	3.71	19.89	0.7	[OK]
45	(4)	45	14.07.2021 15:12	20	3.68	21.24	0.8	[OK]
46	(4)	45	14.07.2021 15:14	20	3.65	20.80	0.8	[OK]

Legend:

- No. Consecutive numbering of the impacts
 Target Impact points according to chapter 4.1
 A Angle of impact (90=perpendicular impact, 45=Façade)
 Time Date and time (CET)
 Ø Projectile diameter
 M Measured mass of the ice ball
 V Measured impact velocity
 E Calculated impact energy
 R [OK] = Valid shot without damage. [X] = Non-valid shot. [B] = Specimen is damaged.

Damages:

- * Visible dent (Figure 8)
 ** Visible dent and a surface deformation or an internal material defect visible (Figure 7)



Figure 7: Visible dent and a surface deformation and an internal material defect visible (shot with a diameter of 50 mm)



Figure 8: Visible dents (shots with a diameter of 30 mm)

5 Evaluation

5.1 Component function

The component is tested for watertightness, light transmission (where applicable) and appearance.

5.2 Damage criterion

Watertightness: If the test specimen has no cracks or punctures, it is considered to be undamaged regarding watertightness. If the test Specimen is torn or punctured, it is considered to be damaged regarding watertightness.

Light transmission, appearance: The plastic sheet is not damaged in terms of appearance and light transmission provided the impact has not caused any surface changes or internal material defects. If any surface changes or internal material defects are visible, the plastic sheet is considered to be damaged. Impact-resistant PMMA is considered to be undamaged regarding appearance and light transmission provided no micro-stretching occurs (bluish-white spots).

5.3 Measuring method

Watertightness: Watertightness is tested based on whether puncturing occurs. If a puncture is not visible to the naked eye (specimen - tester distance of no more than 0.5 m), the vacuum test is carried out according to EN 13583.

Light transmission: Light transmission is tested based on whether micro-stretching or any other internal material defect limiting light transmission occurs. Visual tests for micro-stretching or internal material defects are made against a light at a distance of 5 m.

Appearance: The appearance must be tested in daylight or artificial light at a distance of 5 meters between the test specimen and tester. Depending on the product and intended use, it may be necessary to test the appearance of both sides.

5.4 Evaluation

After the testing with a certain ice ball diameter, the different functions of the test samples as defined in ACFI test procedures have been rated according to the regulations in ACFI test procedures as follows:

Angle of impact	90° - Roof					45° - Façade				
Component's function	HW1	HW2	HW3	HW4	HW5	HW1	HW2	HW3	HW4	HW5
Watertightness	--	OK	OK	OK	OK	--	OK	OK	OK	OK
Light transmission	--	OK	OK	X	X	--	OK	OK	OK	X
Light shielding	--	--	--	--	--	--	--	--	--	--
Mechanical performance	--	--	--	--	--	--	--	--	--	--
Appearance	--	OK	X	X	X	--	OK	X	X	X

Legend:

- OK No reduction of the component's function.
- X Impairment of the component's function.
- Not tested/ not assessed.
- N No rating of the component's function required.
- ? Rating is not possible.

6 Additional brand names

The product is also offered under the following brands and brand names:

- None

Annex A Drawings and specifications

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N./No. | Page / Page
1 / 4

Riv | Date / Date
00 | 13-09-2021

Cod. / Part # |
2732 / 2733

arcoPlus® 626 TRS / arcoPlus® 626 TRS Reverso Prodotto / Product / Produit / Produkt / Producto

Pannello modulare a giunto d'unione in policarbonato alveolare Extra performance TAURUS
 Polycarbonate multiwall modular connector panel Extra performance TAURUS
 Plaque modulaire connectable en polycarbonate alvéolaire Extra performance TAURUS
 Polycarbonat Holkammerpaneel mit Verbindungselement Extra performance TAURUS
 Panel modular con perfil de union en policarbonato celular Extra performance TAURUS

Caratteristiche di produzione | Production features | Caractéristiques de production | Produktionsmerkmale | Características productivas

Production Features	Unit	Value
Spessore Thickness Épaisseur Stärke Espesor	mm	20
Struttura Structure Structure Struktur Estructura		6 pareti 6 walls 6 parois 6 Wände 6 paredes
Larghezza Width Largeur Breite Ancho	mm	600
Lunghezza Length Longueur Länge Longitud	mm	Senza limiti Unlimited Sans limites Unbeschränkte Sin límites
Raggio minimo di curvatura a freddo Minimum cold bending radius Rayon minimum de courbure à froid Mindestkalbiegeradius Radio mínimo de curvatura en frío	mm	4.000
Protezione UV UV protection Protection UV UV Beschichtung Protección UV		Protezione su due lati Protected on both sides. Protection sur les deux côté Beidseitig UV-beschichtet Protección ambas caras
Applicazione Application Application Anwendung Aplicaciones		Facciata Facade Bardage Fassade Fachada Copertura continua Continuous roofing Couverture continue Überdachungen bedachung Cubierta continua Lucernario Skylight Lanterneau Oberlicht Lucernario Copertura curva Curved roofing Couverture cintrée Gebogene abdeckung Cubierta curva
Conformità normativa Regulatory compliance Conformité réglementaire Einhaltung gesetzlicher Vorschriften Cumplimiento normativo		EN 16153:2013-A1:2015 Reg. (EU) 305/2011 (CPR) (1)


(1) DOP disponibile | DOP available | DOP disponible | DOP unter | DOP disponible @https://www.gallina.it

Proprietà generali | General Properties | Propriétés générales | Allgemeine Eigenschaften | Propriedades gerais

Properties	Symbol	Method	Unit	Value
Trasmissione termica Thermal transmittance Transmission thermique Wärmedurchgang Transmittancia térmica	U_{nw}	EN ISO 10077-2	W/m ² ·K	1,7
	U_{hw}	EN ISO 10077-2	W/m ² ·K	1,8
Isolamento acustico Sound insulation Isolation acoustique Schalldämmung Aislamiento acústico	$R_w (C; C_2)$	EN ISO 717-1	dB	20 (-1; -2)
Reazione al fuoco Reaction to fire Réaction au feu Brandverhalten Reacción al fuego		EN 13501-1	Class	B - s1, d0
Comportamento al fuoco proveniente dall'esterno External fire performance Performance au feu extérieur Außenseitiges Brandverhalten Comportamiento frente al fuego exterior		EN 13501-5	Class	F _{ROOF}
Resistenza meccanica (comportamento alla deformazione) Mechanical resistance (deformation behaviour) Résistance mécanique (comportement de déformation) Mechanische Festigkeit (Verformungsverhalten) Resistencia mecánica (comportamiento de deformación)	B_x	EN 16153	Nm/m	-
	B_y	EN 16153	Nm/m	-
	S_y	EN 16153	N/m	-
	M_0	EN 16153	Nm/m	-
Resistenza all'urto di un corpo duro di piccole dimensioni Small hard body impact resistance Résistance au choc d'un corps dur de faibles dimensions Geringe Widerstandsfähigkeit bei harten Stößen Resistencia al impacto de un cuerpo duro con pequeñas dimensiones		EN 16153		Conforme Pass Conforme Bestanden Cumple

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N./Nr. Pag. / Page
 Rev. 2 / 4
 00 Data / Date
13-09-2021
 Cod. / Part# SP
 2732 / 2733 -

Proprietà general | General Properties | Propriétés générales | Allgemeine Eigenschaften | Propriedades gerais

Properties	Symbol	Method	Unit	Value
Resistenza all'urto da corpo molle di grandi dimensioni (montaggio) Large soft body impact resistance (assembly) Résistance au choc d'un corps mou de grandes dimensions (montage) Hohe Widerstandsfähigkeit bei weichen Stößen (Montage) Resistencia al impacto de cuerpo blando de grandes dimensiones (montaje)		EN 15153		-
Potere calorifico inferiore Lower heating value Pouvoir calorifique Brennwert Poder calorífico	LHV	EN 15153	MJ/kg	29,8
Dilatazione termica lineare Linear thermal expansion Dilatation thermique linéaire Wärmeausdehnungskoeffizient Dilatación térmica lineal	α	EN 15153	mm/m·K K ⁻¹	0,065 65 × 10 ⁻⁶
Permeabilità al vapore acqueo Water vapour permeability Permeabilité à la vapeur d'eau Wasserdampfdurchlässigkeit Permeabilidad al vapor de agua	δ	EN 15153	mg/m·h·Pa	3,8 × 10 ⁻⁶
Temperatura di rammolimento Vicat Vicat softening point Point de ramollissement Vicat Vicat-Erweichungstemperatur Punto de reblandamiento Vicat		ISO 306 (B 50)	°C	146 - 151
Temperatura di impiego Operating temperature Température d'exploitation Gebrauchstemperatur Temperatura de uso			°C	-40 / +120
Durabilità Durability Durabilité Haltbarkeit Durabilidad ⁽¹⁾	$\Delta T_{\Delta Y}$	EN 15153	Class	$\Delta A^{(1)}$; $\Delta D^{(1)}$
	ΔE	EN 14963 / EN 1873	Class	Cu 1
	$\Delta \sigma$	EN 14963 / EN 1873	Class	Ku 1


⁽¹⁾ Garantie 20 anni | 20 years warranty | Garantie 20 ans | 20 Jahre Garantie | Garantia 20 años
⁽²⁾ Cristallo | Clear | Cristal | Farblos | Cristal
 Altri colori | Other colours | Autres couleurs | Andere Farben | Otros colores

Treatment(s) | treatments | Traitements | Behandlungen | Tratamientos

UV-TECH
BICOLOR

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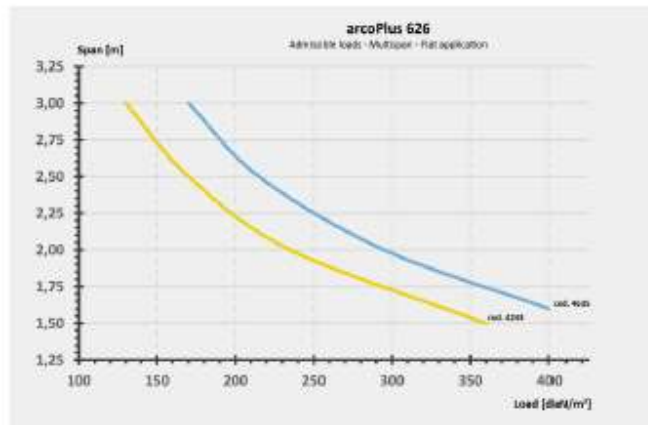
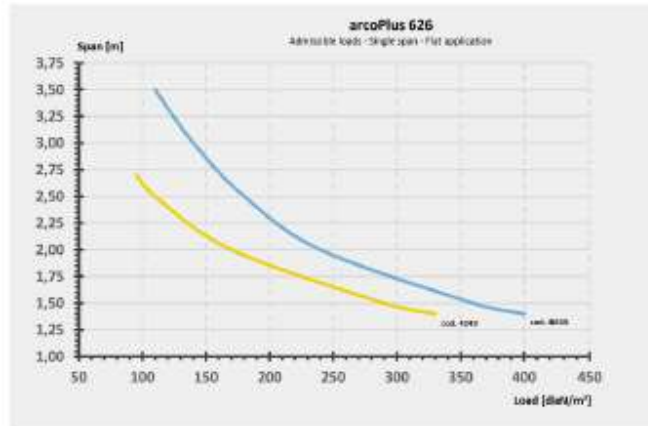
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N. / Nr.
Rw.
Cod. / Part #
2732 / 2733

Page / Page
3 / 4
Date / Date
13-09-2021
SP

Resistenza al carico | Load resistance | Résistance à la charge | Belastungswerte | Resistencia a la carga ⁽¹⁾

⁽¹⁾ (valor) di resistenza al carico varia in funzione del profilo di giunzione utilizzato | The load resistance values depend on the joining profile used | Les valeurs de résistance à la charge varient en fonction des profils de jonction utilisés | Der Lastwert ändert sich in Abhängigkeit der Verbindungprofile ab | La resistencia a la carga varía según los perfiles de unión utilizados



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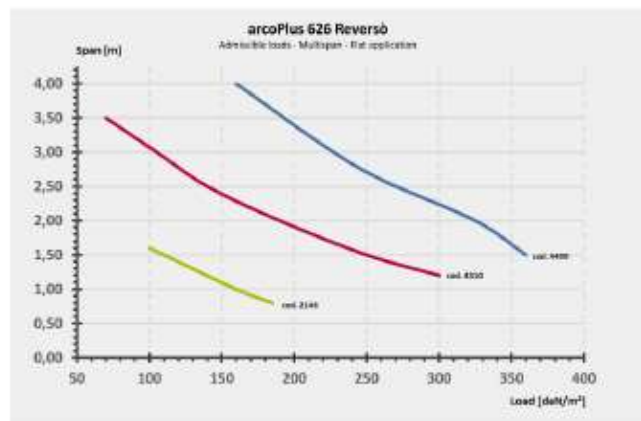
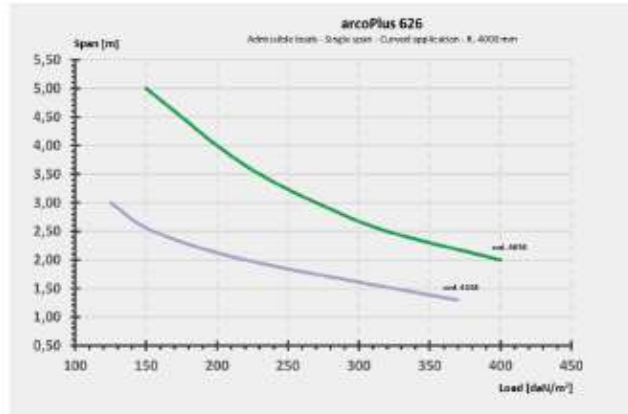




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Page / Page
4 / 4
Date / Date
13-09-2021
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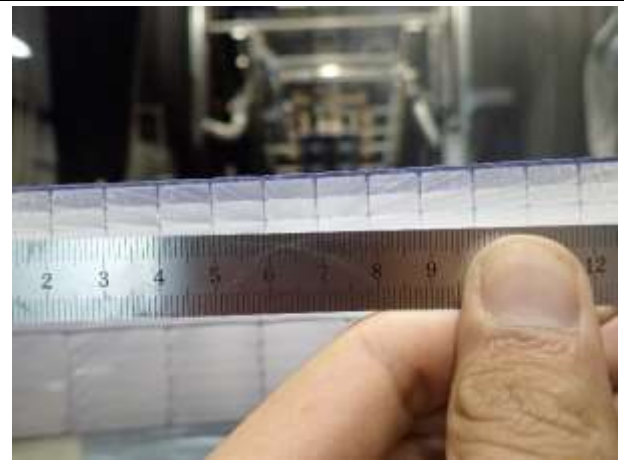
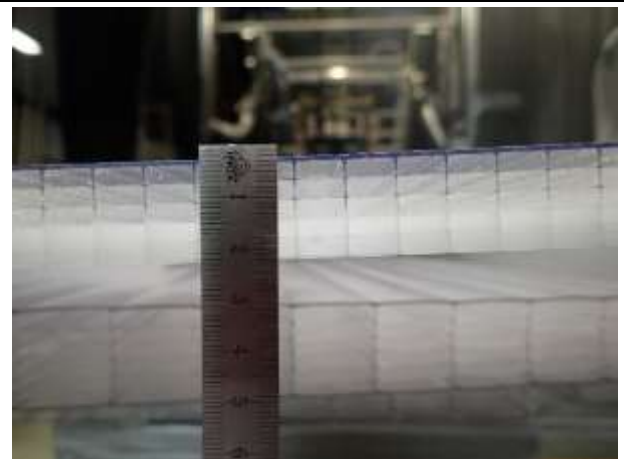
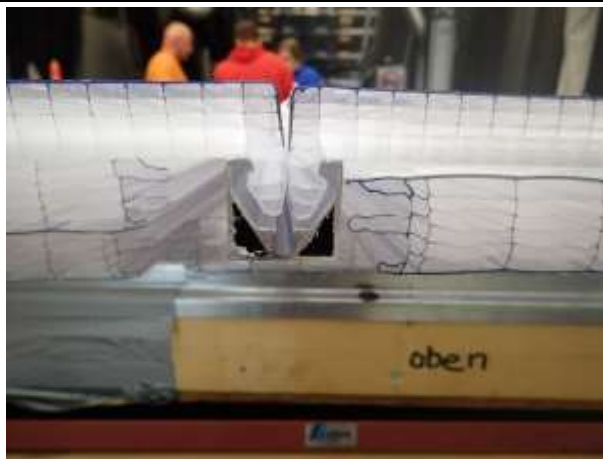
Omologazioni tecniche | Technical approvals | Agrément techniques | Technische Zulassungen | Aprobaciones técnicas

Product	Document	Number	Publication Date	
arcoPlus® 626	CCFAT Document Technique d'Application	2.2/11-1485_V1	31/07/2017	
arcoPlus® 626 Reverso	CCFAT Document Technique d'Application	5.1/19-2581_V1	21/11/2019	

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Measured dimensions:

Overall thickness:	37/20 mm
Cell width:	10 mm
Top and bottom layer:	> 1.0 mm
Bars:	> 0.5 mm
Horizontal sheets:	0.1 mm